PATENT SPECIFICATION (11) 1 403 049

1 403 049

(21) Application No. 46991/72 (22) Filed 11 Oct. 1972 (19)

(23) Complete Specification filed 26 Sept. 1973

(44) Complete Specification published 13 Aug. 1975

(51) INT. CL.[2] E01C 23/04

(25) Index aacceptance
E1G 54 55

(72) Inventor DOUGLAS STANLEY ELBOURNE

(54) A METHOD OF, AND APPARATUS FOR, POSITIONING JOINT MEMBERS IN CONCRETE

(71) We, JOHN LAING AND SON LIMITED, of 133—139 Page Street, Mill Hill, London, NW7 2ER, a British Company, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

The present invention relates to a method of, and apparatus for, positioning joint members, hereinafter referred to as dowel bars, in concrete by means of which the adjacent ends of two concrete slabs, i.e. the transverse joint, are maintained in alignment. The apparatus according to the present invention may either be mounted on a slipform paver, or attached thereto.

As is well known slipform pavers take many forms, but basically they all comprise a machine which lays a continuous slab of concrete along a predetermined path and has a feeding arrangement by means of which a supply of wet concrete is placed at the forward end of the machine, a slipform positioned along each side of the machine which together define the sides of the finished slab and between which the wet concrete is deposited, a spreader which strikes off the concrete to a suitable height, vibrating means which fluidises and compacts the deposited concrete, and conforming or finishing means which, together with the slipforms, determine the final contour of the slab.

A plurality of spaced, horizontally disposed, parallel dowel bars are positioned in the concretein vertical alignment with the transversely extending joint formed by the adjacent ends of two slipformed concrete slabs and the supporting and positioning of such dowel bars during the forming of the concrete slabs presents difficulties.

In one known arrangement a cage supports each dowel bar during placing of the concrete. Such arrangement suffers from the disadvantages that the cage must be rigidly constructed and is therefore costly, and in operation, the cages obstruct access for concrete supply vehicles and the presence of the cages also results in areas of incompletely compacted concrete which tend to impair its strength.

In an attempt to overcome the above disadvantages, a technique has now been developed in which the dowel bars are fed horizontally into the wet concrete through a dispensing tube, but with this method, the timing of the placement of each bar is critical as if the concrete in the placement area is too wet the bar will move vertically or laterally beyond permitted tolerances, and if the concrete in placement area is too stiff or settled, the void left by the dowel bar dispensing tube will not be reformed so that the bond between the dowel bar and the surrounding concrete is ineffective and the longitudinally extending voids produce lines of weakness in the formed slabs.

It is thus an object of the present invention to overcome the disadvantages referred to above and to provide an apparatus whereby the dowel bars can be accurately positioned without the use of supporting cages or dispensing tubes.

The present invention consists in a method of positioning dowel bars in concrete comprising the steps of anchoring one end of a length of filamentary material, tensioning said filamentary material, and then inserting said tensioned filamentary material and dowel bars which are attached thereto at spaced intervals, into a bed of wet concrete.

The invention further consists in a dowel bar positioning apparatus comprising, a filamentary material storage means, a filamentary material tensioning means and insertion means which, in use, places the filamentary material together with dowel bars which are attached thereto at spaced intervals, into a bed of wet concrete.

In the accompanying drawings:—

Figure 1 is a side view of an apparatus for positioning dowel bars in concrete ac-

[*Price 33p*]

cording to the present invention, shown mounted on a slipform paver;

Figure 2 is a perspective view of part of the apparatus shown in Figure 1;

Figure 3 is a cross-section of the apparatus taken on the line 3—3 of Figure 1;

Figure 4 is a side elevation showing details of the dowel bar magazine and conveyor mechanism;

Figure 5 is a cross-section taken on the line 5—5 of Figure 4;

Figures 6*a*, 6*b*, and 6*c* show alternative methods of fixing the dowel bars to the filamentary material, and

Figure 7 is a side view of an alternative apparatus for positioning dowel bars in concrete according to the present invention, shown mounted on a wheeled frame.

In carrying the invention into effect according to one convenient mode, by way of example, the slipform paver shown in Figure 1 basically comprises a chassis frame 10 on which is mounted a screw 11 for spreading the wet concrete deposited in front thereof, a plurality of transversely spaced vibrators 12, a vibrating metering screed 13, primary and secondary oscillating finishers 14 and 15 respectively, and a fine surface finisher 16, all of known construction.

A plurality of dowel bar positioning means 17 are mounted at regularly spaced intervals transversely of the machine and each positioning means comprises a wire storage drum 18, an insertion disc 19, a dowel bar magazine 20 and a conveyor mechanism 21 for moving dowel bars 22 from the magazine 20 towards the insertion disc 19 as hereinafter described.

The wire storage drum 18 is rotatably mounted on a spindle 23 extending between spaced upstanding flanges 24 positioned at the rear of the chassis frame 10 and the insertion disc 19 is rotatably mounted on a shaft 25 at the forward end of a frame 26, the latter being pivotally mounted at 24 on the forward end of the chassis frame 10 so that the height of the lowermost portion of the periphery of the disc 19 is adjustable relatively to the upper surface of the slab. An adjustable turnbuckle arrangement 27 interconnects the frame 26 and the chassis frame 10 to effect such adjustment.

The storage drum 18 and the insertion disc 19 are in longitudinal alignment with one another and the periphery of the latter is provided with a circumferential groove 28, the walls of which are covered with a material, such as rubber, so that a tensioning member in the form of a wire 29 passing therearound is gripped by the walls of the groove 28. The wire 29 in transferring from the drum 18 to the disc 19 passes over a guide roller 30 and under a guide roller 31 positioned at a lower level so that the run of the wire 29 from the roller 31 to the disc 19 is substantially parallel to the conveyor mechanism as hereinafter described. A wire tensioning device 32 is positioned between the rollers 30 and 32 to apply a predetermined tension of say 100—200 lbs to the wire 29.

The magazine 20 has a hopper portion 33 leading to spaced walls 34, the spacing of which is only a little more than the diameter of the dowel bars 22. As can be clearly seen from Figure 5, the lower end of the walls 34 are cranked to clear the run of the wire 29 and one of the walls 34 is bent over at 34*a* to form a slot 35, the slot 35, the width of which is less than the diameter of the dowel bars 22.

The conveyor mechanism 21 comprises spaced sprockets 36 and 37 rotatably mounted between spaced plates 38 with an endless conveyor chain 39 passing around the sprockets 36 and 37. The sprockets 36 of all the dowel bar positioning means 17 are mounted on a common drive shaft 40 which is driven from a drive unit 41 through a drive chain 42 at the same speed as the forward movement of the apparatus. The upper run of the conveyor chain 39 is supported by a plurality of spaced sprockets 43.

The conveyor chain 39 is provided with upstanding support members 44 and 45 spaced according to the required spacing of the joints, each support member having an arcuate support surface 46 for receiving a dowel bar 22. The rearward member 45 of each pair (viewed in the direction of travel of the conveyor chain 39) is provided with an upstanding abutment portion 47 which, in use, passes through the slot 35 of the magazine 20 to remove the lowermost dowel bar 22*a* therefrom (see Figure 4) and convey it on the members 44 and 45 towards the insertion disc 19. During its movement towards the disc 19 each dowel bar 22 is attached to the wire 29 by an operator as shown in Figure 1.

It will be appreciated that the spacing of the dowel bars is dependant on the required spacing between adjacent transverse joints. Three methods of attachment are shown in Figures 6*a* to 6*c*. In Figure 6*a* the wire 29 is attached to the dowel bar 22 by means of binding wire 48, whilst in Figure 6*c* the dowel is provided with a longitudinal groove 49, the sides of which are crimped around the wire 29. The tensioning member may conveniently be a 10 gauge or 12 gauge wire, or may be formed from any form of filamentary material, metal plastics or natural fibre, which is capable of withstanding the required tension. Figure 6*b* shows the dowel bar 22 attached to a steel strip 50 by spot welding.

In operation, the wire 29 of each positioning means passes from the storage drum 18,

around the insertion disc 19 and then rearwardly where it is anchored exteriorly of the machine. The machine advances over the wet concrete with the lowermost periphery of the insertion disc 19 positioned at the required distance below the finished height of the slab being laid and the conveyor mechanism simultaneously removes the dowel bars 22 from the magazine 20 at the required spacing for attachment to the wire 29 by the operator. As the machine advances each tensioned wire and dowel bar assembly passes over the insertion disc 19 and each assembly is held stationary with respect to the ground and the wet concrete slab is cast around the dowel bars. The fact that the bars are inserted in the wet concrete enables the latter, assisted by the vibrators 12, to flow easily around the bars without void, whilst the tensioned wire supports and accurately positions the dowel bars.

In a modification of the invention shown in Figure 7, the dowel bar positioning apparatus 17 is shown mounted on a wheeled frame 55 which is connected to a slipform paver 56 by a pivotally connected beam 57. The storage drum 18, magazine 20 and conveyor mechanism are all similar to the apparatus described above and therefore further description hereof is deemed to be unnecessary. The constructional differences of the modified aparatus reside in that each wire 19 passes from the rear of the frame 55 through a downwardly directed gide channel 58 and then passes under an insertion blade 59 having a guide groove (not shown).

The blade 59 is pivotally mounted at 60 on the slipform paver 56 and an adjustable turnbuckle arrangement 61 interconnects the blade 59 and the paver 56 so that the height of the lowermost portion of the blade can be adjusted relatively to the upper surface of the slab. Thus, in operation, the wire 29 passes from storage drum 18 which is mounted adjacent the front of the frame, through the guide channel 58, under the blade 59 and is then anchored at the rear and exteriorly of the paver 56. It will be appreciated that the dowel bars 22 are attached to the wire 29 prior to it passing through the channel 58 and that, if desired, such attachment could be effected mechanically or automatically. Furthermore, the conveyor mechanism could be of some other form, such as a belt.

WHAT WE CLAIM IS:—

1. A method of positioning dowel bars in concrete comprising the steps of anchoring one end of a length of filamentary material, tensioning said filamentary material, and then inserting said tensioned filamentary material and dowel bars which are attached thereto at spaced intervals, into a bed of wet concrete.

2. A method as claimed in claim 1, wherein the dowel bars are attached to said filamentary material after tensioning thereof.

3. A method as claimed in claim 1 or 2, wherein the dowel bars are attached to said filamentary material by binding wire, welding or crimping.

4. A dowel bar positioning apparatus comprising, a filamentary material storage means, a filamentary material tensioning means and insertion means which, in use, places the filamentary material together with dowel bars which are attached thereto at spaced intervals, into a bed of wet concrete.

5. An apparatus as claimed in claim 4, including a dowel bar magazine and a conveyor mechanism for moving dowel bars from the magazine towards the insertion means.

6. An apparatus as claimed in claim 5, wherein the conveyor mechanism comprises an endless conveyor chain passing around spaced sprockets, said chain being provided with spaced dowel support members including an abutment portion which, in use, passes through a slot in the lower end of the magazine to remove the lowermost dowel bar therefrom.

7. An apparatus as claimed in claim 6, wherein one of said sprockets is driven from a drive unit through a drive chain, the upper run of said chain being supported by spaced sprockets.

8. An apparatus as claimed in any of claims 4 to 7, wherein said insertion means comprises a disc around which the filamentary material and dowel bars pass prior to being placed in wet concrete.

9. An apparatus as claimed in any of claims 4 to 7, wherein said insertion means comprises a blade under which the filamentary material and dowel bars pass prior to being placed in the wet concrete.

10. An apparatus as claimed in any of claims 4 to 9, wherein said insertion means is movable relatively to the apparatus so that the height of the lowermost portion of said insertion means is adjustable relatively to the upper surface of the concrete slab being laid.

11. An apparatus as claimed in claim 10, wherein the insertion means is pivotally mounted on said apparatus and a turnbuckle arrangement provides said adjustment.

12. An apparatus as claimed in any of claims 4 to 11, in combination with a slipform paver.

13. A method of positioning dowel bars in concrete substantially as described.

14. A dowel bar positioning apparatus substantially as described with reference to Figures 1 to 5, or Figure 7 of the accompanying drawings.

MARKS & CLERK,
Chartered Patent Agents,
57 & 58 Lincoln's Inn Fields,
London, WC2A 3LS,
Agents for the Applicants.

Printed for Her Majesty's Stationery Office by Burgess & Son (Abingdon), Ltd.—1975.
Published at The Patent Office, 25 Southampton Buildings, London, WC2A 1AY,
from which copies may be obtained.

1403049 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

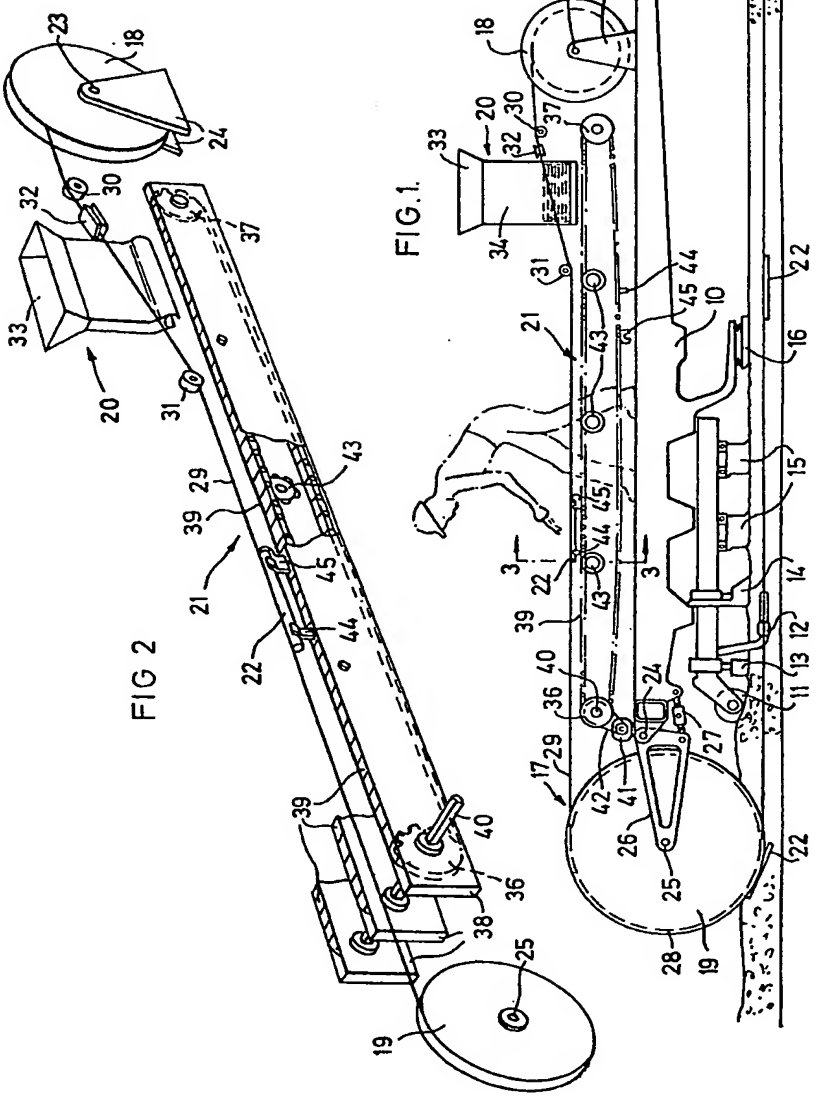

FIG 2

FIG.1.

1403049 COMPLETE SPECIFICATION
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 2

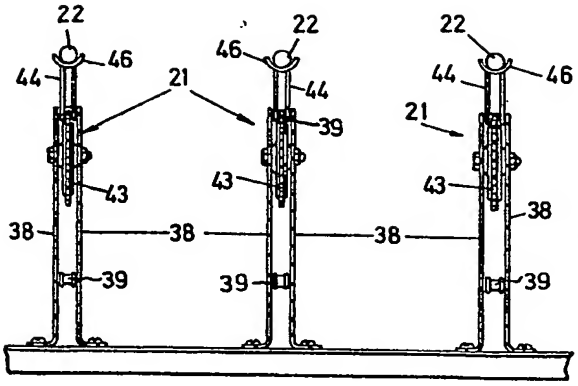

FIG. 3.

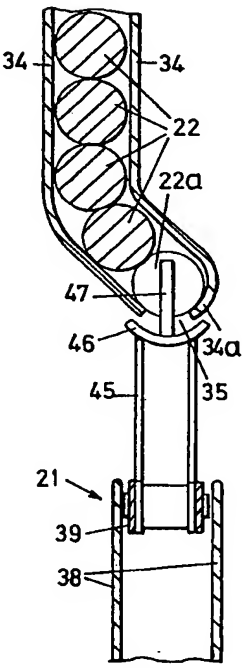

FIG. 5.

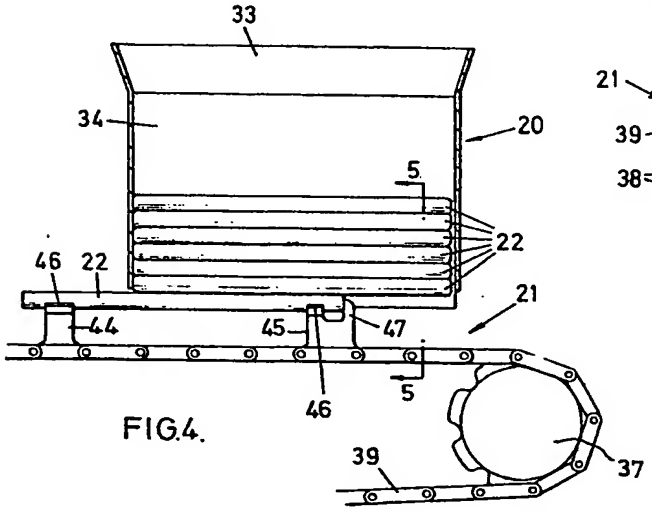

FIG.4.

1403049 COMPLETE SPECIFICATION
3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheet 3

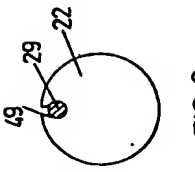

FIG.6c

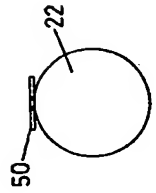

FIG.6b

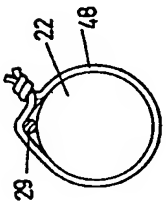

FIG.6a

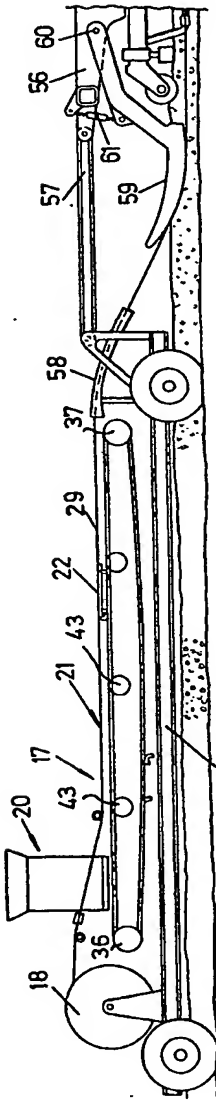

FIG.7